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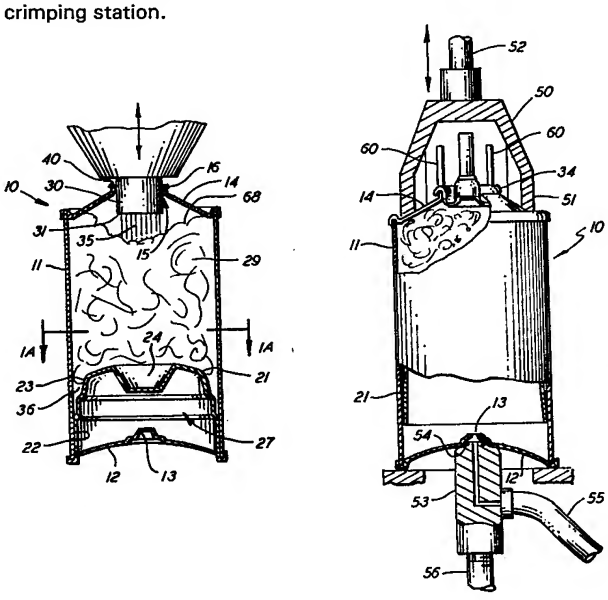
(54) **Method for filling an aerosol can with a viscous product.**

(57) A piston type aerosol can (10) is filled with a viscous product by a nozzle (30) positioned near the top wall (14) opening of the can during the entire step of discharging the viscous product into the can. The nozzle preferably prevents substantial expansion of the jet of viscous product that exits the nozzle. When the jet of viscous product strikes the piston (21) in the lower portion of the can, a slight cavitation results and the viscous product spreads towards the side wall (23) of the can and fills the region (36) between the skirt of the piston and the side walls of the can. After the can has been filled with the viscous product, a gaseous pressure may be introduced at the top wall opening of the can to force the viscous product into contact with the top surface of the piston and completely into the region between the skirt of the piston and the side walls of the can. A track assembly (60) may be provided at a piston moving or positioning station with the track assembly extending toward a valve assembly crimping station wherein the track assembly maintains a valve assembly means (25) in position within the top wall opening (15) of the aerosol can during a piston raising step while permitting slight upward movement of the valve assembly to allow gas to escape from the can. Extending the track assembly (60) in the direction of the crimping station prevents the valve assembly from becoming misaligned due to residual pressure in the can as the can is transported from the piston raising station to a valve assembly/can top wall crimping station.



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METHOD FOR FILLING AN AEROSOL CAN WITH A VISCOUS PRODUCT

This invention relates to aerosol cans of the type which house a piston slidable along the axis of the can and which contain a viscous product. More particularly, this invention relates to an improved method of filling an aerosol can having a piston slidable along the axis of the can with a viscous product.

Aerosol cans or containers which have a piston slidable along the axis of the can have been used for many years for dispensing viscous products such as cheese spreads and toothpaste. The product to be dispensed occupies the region within the can above the piston and a pressurized fluid, usually air, occupies the region below the piston. When the valve at the top of the can is manipulated to open it, the pressurized fluid is able to push the piston toward the top of the can, and the piston in turn pushes some of the viscous product out of the can through the valve. Aerosol cans of this type are discussed in U.S. Patent No. 3,897,672 to Scheindel.

The prior art has faced many problems in connection with filling such a can with the viscous product to be dispensed.

The prior art methods for dispensing a viscous product into the can required expensive equipment and was relatively slow. One such prior art method comprises inserting a tubular dispensing member into the can with its discharge end positioned near the piston (which would be at its lowermost position near the bottom of the can) at the commencement of filling. The diameter of the tubular

dispensing member is substantially less than the diameter of the hole in the top wall of the can through which it is inserted. Viscous product is pumped through the tubular dispensing member and as viscous product flows out of the tubular member into the can, the can is lowered as the viscous product is introduced into the can. Alternately, the tubular dispensing member may be retracted from the can as the viscous product is introduced into the can. This alternate prior art method of filling the can with viscous material is discussed in U.S. Patent No. 3,897,672 in conjunction with Fig. 1 of that patent.

In either of these prior art methods for dispensing the viscous product into the can, expensive equipment was necessary for either lowering the can or withdrawing the tubular dispensing member from the can. As previously discussed, these prior art methods were relatively slow which is disadvantageous in automated can filling operations.

The prior art methods for dispensing viscous products into a can commenced with the nozzle or discharge end of the tubular dispensing member positioned near the piston at the bottom of the can in an attempt to try to fill the region above the piston with the viscous product. In practice, air spaces or voids usually remained in the region of the surface of the piston, particularly near the outer periphery or margin of the piston adjacent the side walls of the can. This created the following problem in the prior art.

As discussed in U.S. Patent No. 3,897,672, cans of this type usually have a longitudinally extending seam. In a seamed can, the internal periphery of the can is not perfect-

ly circular because the seam projects into the can. The piston is a hollow and thin-walled member and is formed of a flexible material such as a suitable plastic. However, the piston will not conform exactly to the internal shape of the can in the vicinity of this seam. A small space will remain between the piston side surface and the can interior surface on each side of the seam.

The top of the piston is generally shaped somewhat like a truncated cone so as to generally conform to the top wall of the aerosol can. The prior art viscous product filling methods typically left voids or air spaces in the region of the outer periphery or margin of the piston. Upon completion of the filling of the can, an air space usually also remained above the product at the top of the can, particularly in the region near the side walls of the can. As a result, when the can is laid on its side for a considerable amount of time [a condition which is not unusual in normal handling of the can], the viscous product has an opportunity to settle into these air spaces thereby leaving a channel or air space running along the entire length of the can between the piston and the top of the can where the valve is located.

If the can is now picked up and used, opening the valve permits the pressurized air to flow from beneath the piston through the spaces between the piston sidewall and the can wall on each side of the seam, through the channel alongside the product, and out through the valve. The pressure beneath the piston is therefore reduced and the ability of the piston to push the product out of the can is greatly hindered or eliminated. Therefore, some or all of the vis-

cous product can never be dispensed from the can. Any product which cannot be dispersed is wasted.

In order to eliminate this prior art problem, U.S. Patent No. 3,897,672 proposed to apply a vacuum to a hole located at the bottom of the can after the can had been filled with viscous product. The vacuum would draw the viscous product toward the top of the piston upper surface area and between the piston outer periphery and the side walls of the can in order to fill any voids between the product and the piston.

Although the vacuum drawing method of U.S. Patent No. 3,897,672 is successful in substantially eliminating voids or air spaces between the piston and viscous product, this vacuum drawing method is relatively slow. The relative slowness is disadvantageous in automated can filling operations. The use of vacuum is very limiting in high speed filling operations.

Another disadvantage of the hereinbefore discussed prior art methods of introducing a viscous product into a can by either lowering the can or alternately withdrawing the tubular dispensing member from the can as the viscous product is being introduced into the can is that the viscous product upper surface has a cone shaped configuration after the can has been filled. This is illustrated, e.g., in Fig. 1 of U.S. Patent No. 3,897,672. After the viscous product is dispensed into the can, a valve assembly is seated on the edge surrounding the top wall opening of the can but is not fastened to the can. The piston is then moved upwardly in the can by applying compressed air to the hole at the bottom of the can. Upward movement of the piston forces the viscous

product upward in the can and expels air remaining in the can above the upper surface of the viscous product. The air flows out the top opening of the can between the edge on which the valve assembly is seated and the valve assembly. The viscous product is not forced out of the can.

Due to the cone shaped configuration of the viscous product resulting from the prior art methods of introducing the viscous product into the can, air will remain trapped between the upper surface of the viscous product and the top of the can in the region of the can near the sidewalls. This trapped air results in undesirable "foaming" or "sputtering"of the viscous product when it is dispensed from the can.

Another disadvantage of prior art can filling operations is as follows. When the piston is moved upward in the can in order to expel air remaining between the top of the can and the viscous product, the valve assembly must be restrained within the top wall opening of the can. After the air is expelled, the can is moved to a crimping station for fastening of the valve assembly to the top edge of the can in an airtight manner. Although the valve assembly was restrained within the top wall of the can at the work station where the piston was moved upward and the air expelled, the prior art does not restrain the valve assembly when the can is being transported from the piston moving station to the crimping station. Accordingly, if there is any residual pressure remaining in the can during the transport of the can from the piston moving station to the valve assembly crimping station, the residual pressure could cause the valve assembly to become misaligned with respect to the opening in top wall

of the can while the can is being transported. This misalignment of the valve assembly during transport of the can to the crimping station results in a disadvantageous relatively high rejection of cans due to improper crimping of the valve assembly to the can edge on which the valve assembly was seated. In addition, jamming may occur at the crimping station which will require stopping the production process while the jam is being cleared.

It is therefore an object of the present invention to provide an improved method of filling a piston-type aerosol can with a viscous product.

It is another object of the present invention to provide a method for dispensing a viscous product into a piston-type aerosol can which is relatively fast in comparison with prior art methods and which eliminates expensive equipment for moving the can to be filled and a tubular dispensing member relative to each other during the dispensing of the viscous product into the can.

It is yet another object of the present invention to provide an improved method for eliminating air spaces or voids between a viscous product and a piston in a piston-type aerosol can.

It is still another object of the present invention to avoid the use of a relatively slow vacuum step in order to eliminate air spaces and voids between a viscous product and a piston in a piston-type aerosol can.

It is a further object of the present invention to provide an improved method of filling a piston-type aerosol can wherein air spaces or voids located between the upper

surface of a viscous product which has been introduced into the can and the top wall of the can in the region near the side walls of the aerosol can may be substantially eliminated.

It is yet a further object of the present invention to provide an improved nozzle for the introduction of a viscous product into a piston-type aerosol can.

It is still a further object of the present invention to provide a method and means for filling a piston-type aerosol can with a viscous product wherein a valve assembly seated on an edge member surrounding a top wall opening of the can is substantially prevented from becoming misaligned upon transporting the can from a piston moving station for the expulsion of excess air to a valve assembly crimping station.

These and other objects will become apparent from the following description and claims in conjunction with the drawings.

The present invention may be generally summarized as a method of filling and pressurizing a can having a top end with an opening, a side wall, a bottom wall formed with a hole, wherein said side wall and said bottom wall provide an enclosed volume, and a piston positioned within said can enclosed volume, said piston having a periphery closely adjacent said side wall, with said piston being slidable along the axis of the can, said method comprising the steps of:

(a) positioning a nozzle having a discharge end with a discharge orifice so that said discharge

orifice is located near said top opening of said can;

(b) dispensing a viscous product flowing under pressure in said nozzle into said can enclosed volume through said nozzle with a pressure sufficient for causing said viscous material impinging on said piston to spread toward the periphery of said piston and said side wall;

(c) continuing dispensing said viscous product into said can enclosed volume through said nozzle in order to fill said can with a selected amount of said viscous product;

(d) maintaining the position of said nozzle near said top opening of said can throughout said dispensing steps (b) and (c);

(e) maintaining said can stationary with respect to motion parallel to said can axis throughout said dispensing steps (b) and (c);

(f) placing valve assemly means into the top opening of said can after said dispensing steps (b) and (c);

(g) moving said piston upwardly in said can so that said viscous product substantially fills the enclosed volume of said can above said piston while permitting gas to flow out of the top opening of said can during said upward movement of said piston;

(h) applying fluid pressure to the hole at the bottom of said can thereby providing a pressure beneath said piston;

(i) plugging said hole in the bottom of said can;

(j) restraining said valve assembly means in the top opening of said can and restraining said can during said piston moving step (g) said fluid pressure applying step (h) and said plugging step (i); and

(k) maintaining a pressure within said can below said piston at the exterior ambient pressure or greater throughout said steps (a) through (j).

In step (j), the valve assembly means may be restrained, for example, by mechanical means external to the aerosol can or by the means connecting the valve assembly to the body of the can. Step (k) points out that, in accordance with the method of the present invention, a vacuum is not applied to the hole in the bottom wall of the can in order to draw viscous product into voids between the surface of the piston and viscous product.

One important aspect of the present invention is that the viscous product is discharged from the nozzle at high velocity sufficient to cause spreading of a viscous product impinging on the piston at the start of filling toward the side wall of the can.

The nozzle for dispensing the viscous product may have a cross-sectional geometry so that fluid communication between the enclosed volume of the can and the exterior of the can is restricted during the dispensing of a viscous product into the can from the nozzle. This results in building a positive pressure within the enclosed volume of the can during the dispensing of the viscous product which assists in

filling any voids between the viscous product and the piston.

A gaseous pressure may be applied to the top opening of the can after the viscous product is dispensed into the can in order to substantially fill any voids between the viscous product and the piston.

A preferred nozzle for discharging the viscous product into a can will gradually constrict the viscous product flowing in the nozzle. This substnatially prevents expansion of the viscous product upon exiting the discharge orifice of the nozzle and substantially prevents a jet of viscous product after being discharged from the nozzle from expanding.

A pair of parallel, spaced apart tracks may be positioned over the piston moving station to restrain the valve assembly seated on an edge member surrounding the top wall opening of the can during movement of the piston. The spaced apart tracks would extend a distance toward a valve assembly fastening or crimping station sufficient to prevent the venting of pressure from the interior of the can from misaligning the valve assembly with respect to the top wall opening when the can is being transported from the piston moving station to the valve assembly fastening station.

The following is a description of some specific embodiments of the invention, reference being made to the accompanying drawings, in which:

In the drawing, forming part hereof:

Fig. 1 is a schematic vertical cross-sectional view of an aerosol can having a slidable piston positioned at a filling station wherein a nozzle dispenses a viscous product into the can in accordance with the present invention;

Fig. 1A is a portion of a horizontal cross-sectional view taken along line 1A - 1A of Fig. 1;

Fig. 2 is a schematic elevation view, partly in cross-section, similar to the view of Fig. 1 illustrating the dispensing of a viscous product into an aerosol can having a slidable piston at a time just after the start of dispensing of the viscous product and wherein the discharge nozzle has a preferred smooth, gradual converging cross-section near the discharge end of the nozzle;

Fig. 3 is a schematic elevation view, partly in cross-section, of a discharge nozzle having a preferred smooth, gradual converging cross-section near the discharge end of the nozzle for use in discharging a viscous product into an aerosol can such as illustrated in Figs. 1 and 2;

Fig. 4 is a schematic fragmentary elevation view of an alternate location of a discharge nozzle near the top end opening of a piston-type aerosol can in accordance with an alternate embodiment of the present invention;

Fig. 5 is a schematic vertical cross-sectional view illustrating the pressurization through the top opening of a piston-type aerosol can of viscous product disposed in the piston-type aerosol can in order to force the viscous product into contact with the upper surface of the piston and around the skirt of the piston in accordance with the present invention;

Fig. 6 is a schematic vertical cross-sectional view of a piston-type aerosol can filled with a viscous product and having disposed in the top opening thereof a valve assembly means;

Fig. 7 is a schematic elevation view, partly in cross-section, illustrating the upward movement of a piston by means of a pressurized fluid in a piston-type aerosol can

after the can has been filled with a selected amount of a viscous product and also illustrates track members, in accordance with the present invention, for restraining a valve assembly member positioned in a top wall opening of such a can during the upward movement of the piston;

Fig. 8 is a schematic elevation view, partly in cross-section, illustrating a prior art clamping head restraining a piston-type aerosol can and a valve assembly means positioned in the top wall opening of such a can during a piston moving step such as illustrated in Fig. 7;

Fig. 9 is a schematic side elevation view illustrating track members, in accordance with the present invention, extending from a piston moving station as illustrated in Fig. 7 to a valve assembly means crimping or fastening station as illustrated in Fig. 11;

Fig. 10 is a schematic elevation view taken along line 10-10 of Fig. 9 illustrating track members in accordance with the present invention;

Fig. 11 is a schematic elevation view, partly in cross-section, illustrating a crimping station for crimping a valve assembly to the top wall of a piston-type aerosol can; and

Fig. 12 is a schematic elevation view, partly in cross-section, illustrating a station for pressurizing the region of a piston-type aerosol can below the piston and inserting a grommet in a hole located in the bottom wall of the aerosol can.

In the figures of the drawing, like part numbers indicate like parts.

In order to afford a more complete understanding of the present invention and an appreciation of its advantages, a description of the preferred embodiments is presented below.

Fig. 1 illustrates a conventional cylindrically shaped aerosol can or container 10 comprising substantially cylindrical side wall 11 to the bottom edge of which a bottom wall 12 is secured in a fluid-tight manner. Bottom wall 12 is of a downward concave shape so that it will not be bellied out by pressure within the can. The bottom wall 12 is furnished with a hole 13, the purpose of which will hereinafter be described. A top wall 14 is secured in a fluid-tight manner to the upper edge of sidewall 11. The top wall 14 has an opening 15 surrounded by an edge member 16. The type of can described is often referred to in the art as a "three-piece can." Such cans are typically fabricated from sheet metal.

It will be understood that the invention may also be practiced with what is frequently referred to in the art as a "two-piece" can or container in which the side wall and either the top wall or bottom wall are formed as one piece by a deep drawing operation. The invention may also be practiced using what is referred to in the art as a "dimple cup" valve assembly.

In a three-piece can, such as illustrated in Fig. 1, the side wall 11 is formed from initially flat stock which is curved into the cylindrical shape. With reference to Fig. 1A, the two meeting edges 18, 19 are welded together to form a seam 20 extending longitudinally along the can.

Positioned within can 10 is a conventional shell-like piston 21 fabricated, e.g., from a suitable molded plastic such as polyethylene. The piston has a cylindrical side wall 22 merging into a generally frusto-conical shaped top wall 23. The piston is slidable axially (upwardly in Fig. 1) with respect to the can. The piston top wall is formed with a depression 24 adapted to accommodate the portion 26 of a valve assembly 25 (Fig. 6) which projects into the interior of the can. The top wall of the piston 21 is generally shaped to conform to the inner surface of the top wall 14 of the can and the lower portion 26 of valve assembly 25 so that when the piston reaches the top of the can it will have expelled substantially all the product remaining in the can. The interior of the shell-like piston defines a space 27 for accommodating a pressurized fluid.

With reference to Fig. 1A, seam 20 projects into the can making the internal cross-section of the can side wall 11 non-circular in the region of seam 20. When the space 27 within the piston 21 is pressurized [as will hereinafter be discussed] the piston side wall 22 is pressed against the inner surface of can side wall 11 to produce a snug but slidable fit. However, the piston side wall does not have sufficient flexibility to conform to the internal ridge formed by the seam 20. Consequently, spaces 28 result between the piston sidewall 22 and the can sidewall 11 on both sides of the seam 20.

Can 10 is filled with a viscous product 29 by a nozzle 30 which is positioned such that the discharge end 31 forming a discharge orifice is located near the top opening 15 of the can 10. The nozzle 30 would be connected by suit-

able conduit means 32 [Fig. 2] to a reservoir for holding a viscous product to be discharged into the can [the last elements being conventional and not illustrated]. Suitable pumping or pressurizing means [not illustrated] are provided for discharging a high velocity viscous product jet from the nozzle 30 with a pressure sufficient for causing the viscous product impinging on the piston to spread toward the periphery of the piston and the side walls 11 of the can. [Best illustrated in Fig. 2.] When the pressure of the viscous fluid being discharged from the nozzle is sufficient to cause some small amount of cavitation when the jet of viscous product 35 discharged from the nozzle 30 strikes the top surface of the piston 21 at the start of filling the can, this assists the spreading of the viscous product 29 toward the periphery of the piston 21 and the side wall 11 of the can and into the space 36 between generally frusto-conical piston wall section 23 [i.e., the piston skirt] and side wall 11 of the can. Suitable means [not illustrated], such as air cylinders, would be provided for positioning nozzle 30 with respect to top opening 15 of the can.

For many viscous products, selecting an appropriate nozzle discharge pressure for the viscous product will cause sufficient spreading of the viscous product to substantially avoid the formation of voids between the viscous product discharged into the can and the top of the piston including the space 36.

It should be noted that the nozzle 30 is located near the top end of the can 10 during the entire operation of dispensing the viscous product from the nozzle into the can for filling of the can with a selected amount of viscous

product. This increases the speed of filling the can in comparison with prior art methods of filling the can wherein a tubular dispensing member is positioned near the piston at the bottom of the can and either the can was lowered or the tubular dispensing member was withdrawn from the can as the can was filled with a viscous product. In addition, in accordance with the method of the present invention, since the viscous product dispensing nozzle 30 remains stationary near the top end of the can 10 during the filling of the can, the expensive prior art equipment used to move the can and the tubular dispensing member relative to one another responsive to the rate at which the can is filled is no longer required.

A preferred nozzle shape for use in the present invention is illustrated in Figs. 2 and 3. The preferred nozzle shape, as illustrated in Figs. 2 and 3, is a nozzle having a smooth, gradually converging cross-section parallel to the axis of the nozzle [vertical cross-section as illustrated in Fig. 2 and 3]. The smooth, gradually converging nozzle cross-section is suitably located near the discharge end 31 of the nozzle 30. The purpose of such a nozzle is to provide substantially laminar flow [i.e., substantially non-turbulant flow] of the pressurized viscous product as it approaches the discharge end of the nozzle. To obtain such a flow of the pressurized viscous product, it is desirable to avoid abrupt changes in the cross-section of the nozzle conduit in which the viscous product is flowing. A nozzle having the shape as illustrated in Figs. 2 and 3 also substantially prevents expansion of the jet of the viscous product 35 which is being discharged from the discharge

orifice of the nozzle 30. Significant expansion of the jet of viscous product discharged from the nozzle 30 would result in energy losses and degrade the spreading of the viscous product which strikes the upper surface of the piston toward the side walls of the can during the initial filling of the can.

Referring to Fig. 3, discharge nozzle 30 comprises a conduit 39 for transporting a viscous product under pressure. Conduit 39 has a circular cross-sectional area A_1. Near the discharge end 31 of nozzle 30, the circular cross-sectional area of the nozzle fluid conduit 39 is gradually and smoothly contracted 38 to a smaller cross-sectional area A_2. The diameter of the viscous product jet 35 discharged from the discharge orifice of nozzle 30 is D_1. Diameter D_1 is substantially equal to the diameter of the nozzle fluid conduit when it has the cross-sectional area A_2. That is, there is substantially no expansion of the viscous product upon discharge of the viscous product from the nozzle 30. The diameter of the viscous product jet 35 at a distance spaced from the discharge end 31 of nozzle 30 is D_2, where D_2 substantially equals D_1. That is, there is substantially no expansion of the viscous product jet 35 after it has been discharged from the nozzle 30. Thus there are only minimum energy loses in the viscous product jet due to expansion and turbulence in the jet.

As hereinbefore discussed, avoiding expansion and turbulence in the viscous product jet has been found to be important in order to obtain the spreading of the viscous product upon striking the piston wherein striking of the piston by the jet is desirably accompanied by a small amount

of cavitation.

With reference to Fig. 3, examples of suitable dimensions for the nozzle are: A_1 = 1.76 square inches; A_2 = 0.196 square inches; $D_1 = D_2$ = 0.5 inches; angle X = 30°. When the viscous product is latex caulk, a pressure of, e.g., about 36 p.s.i.g. is suitable.

A gradually converging nozzle used to limit the expansion of a jet of discharged fluid is generally known in the field of fluid mechanics. Prior to the present invention, the advantages of using a gradually converging nozzle to fill a piston-type aerosol container with a viscous product had not been known. Heretofore, converging nozzles have not been used with equipment for filling piston-type aerosol containers with a viscous product.

As illustrated in Figs. 1 and 2, the discharge end 31 of the nozzle 30, positioned near the top end of can 10, is disposed within the can 10. In many instances it is desirable that the cross-sectional area of the nozzle 30 adjacent the top end of the can 10 be less than but substantially equal to the cross-sectional area of the top end opening 15 of the can. Thus, only a small annular area 40 will be provided for permitting the escape of air from the interior of the can to the exterior as viscous product 29 fills the can. The interior of the can 10 [i.e., the enclosed volume of the can] may thus be said to be in restricted fluid communication with the exterior of the can. Accordingly, there will be a positive pressure buildup in the can enclosed volume as the can is filled with viscous product. The positive pressure buildup will assist the viscous product filling any voids between the viscous product

29 and the piston 21 and assist in having the viscous product enter space 36 between piston wall 23 and can side wall 11. In many applications, sufficient positive pressure can be built up to force the viscous product between the side of the piston 23 and the side wall of the can 11.

Examples of suitable dimensions are as follows: If the diameter of the top opening 15 of the can is about 1 inch, the external diameter of the nozzle 30 adjacent the top opening 15 of the can may be about 0.975 inches.

An alternative way to build a positive pressure in the can enclosed volume when the viscous product is being dispensed into the can would be to have the discharge end 31 of the nozzle rest on the edge member 16 surrounding the opening 15 of the top wall 14 of the can [not illustrated]. The discharge orifice of the nozzle 30 would be aligned with the top opening 15 of the can. The resting of the discharge end 31 of nozzle 30 on edge member 16 would also result in restricting fluid communication between the internal volume of the can 10 and the exterior of the can thereby causing positive pressure to build in the can when viscous product is being dispensed into the can.

Fig. 4 illustrates an alternate location for the nozzle 30 having a discharge end 31 positioned near the top opening of the can 10 in accordance with the present invention. In this embodiment of the invention, the discharge orifice of the nozzle 30 discharge end 31 is positioned near the top opening 15 of the can 10 but external to the enclosed volume of the can. In this embodiment, it is desirable for the diameter of the nozzle discharge orifice to be substantially less than the diameter of the top opening 15 of the

can. Hence, the diameter of the jet of viscous product 35 discharged from the nozzle 30 will be substantially less than the diameter of the top opening of the can. The reason for this is that if the diameter of the jet of viscous product was close to the diameter of the top opening of the can, rushing air escaping from the can as the can is filled with viscous product will carry with it some of the viscous product trying to enter the can. It will be appreciated that this would cause the spatter of viscous product about the work area.

Dimensions suitable for the practice of the embodiment of the invention illustrated in Fig. 4, could be, for example, the diameter of the nozzle discharge orifice and hence the diameter of the jet of viscous product being about one-half the diameter of the top end opening of the can. It will be appreciated that in embodiments of the present invention as illustrated in Fig. 4, there will not be substantial positive pressure buildup within the enclosed volume of can 10 during the filling of the can with the viscous product.

The next step, in accordance with the present invention, which follows filling the can with a selected amount of viscous material, is optional and would be practiced when circumstances dictate. In some instances, after the filling of a can 10 with a selected amount of viscous product 29, there may remain some spaces or voids between the viscous product and the upper surface of the piston 21 especially in region 36.

In accordance with the present invention, as illustrated in Fig. 5, the viscous product 29 may be forced

further down and around the skirt area 23 of the periphery of upper surface area of the piston 21 in order to fill any voids that may exist in the space 36 between piston surface area 23 and side wall 11 of can 10 by introducing fluid pressure, most suitably gaseous pressure in the form of air pressure, at the top opening 15 of can 10. The pressure should not be so great that it will force the viscous product under the piston 21.

The top wall 14 of can 10 may be engaged by a cylindrical clamping member 42 forming an enclosed hollow space 45. The bottom edge of clamping member 42 is provided with a seal 43, fabricated from an elastomer or rubber like material, for engaging the top wall 14 of can 10. A conduit 44 would be connected to a source of air pressure [not illustrated] and penetrates the wall of clamping member 42 for introducing air pressure on the top of viscous product 29 through top opening 15 of can 10 for further forcing viscous product 29 into contact with the upper surface of the piston and especially into space 36. The top wall of clamping member 42 may be connected by a rod 45 to a suitable means, such as an air operated cylinder [not illustrated], for moving clamping member 42 up and down as desired.

When the can 10 is filled with a viscous product, in accordance with the method of the present invention such as illustrated and described in conjunction with Figs. 1 and 2, the optional pressurization step of the present invention illustrated in Fig. 5 has been found useful when the viscous product is latex caulk or silicone caulk. When the can 10 is filled with a viscous product, in accordance with the method of the present invention such as illustrated and described in

conjunction with Figs. 1 and 2, the optional pressurization step of the present invention illustrated in Fig. 5 has been found generally not to be necessary when the viscous product is cream or gel.

Typical pressures used may be, e.g., about 10 p.s.i.g. to 80 p.s.i.g. The typical length of time of pressurization may be, e.g., about 1 second to 3 seconds. These pressures and times are only given by way of example and it will be understood that others may be used.

The determination of whether or not the optional pressurization step of the present invention is necessary or desirable would depend on factors such as the viscosity of the viscous product introduced into the can, the product flow characteristics, the pressure, and the velocity at which the viscous product is introduced into the can during the filling step, and the size of the can. One skilled in the art could perform routine tests with selected viscous products and selected can sizes and selected filling pressures to determine if the optional pressurization step in accordance with the present invention is desired prior to filling of cans on a production line scale.

The pressurization step of the present invention described in conjunction with Fig. 5 represents an important advance in the art. Heretofore, in order to further force the viscous material around the skirt region of the upper surface of the piston, the prior art used a vacuum method wherein a vacuum was introduced at the hole 13 located in the bottom wall 12 of can 10. Such a method is described in U.S. Patent No. 3,897,672. Although the vacuum method satisfactorily forced the viscous material around the skirt of the

piston, this method was slow and is a very limiting factor in high speed operations. The pressurization method, in accordance with the present invention, will force the viscous product around the piston more rapidly than the prior art vacuum method. It will be appreciated that the higher speed pressurization method of the present invention is complementary to the higher speed automated filling method of the present invention for use in high speed filling operations.

It will be appreciated, that if desired, the vacuum method disclosed in U.S. Patent No. 3,897,672 may be used in combination with the viscous product filling method described herein in conjunction with Figs. 1 to 4. It will also be appreciated that the pressurization method of the present invention used to force viscous material around the skirt of the piston, described in conjunction with Fig. 5, may be usefully employed with prior art methods for dispensing a viscous product into an aerosol container or can.

Although not preferred, the pressurization method of the present invention described in conjunction with Fig. 5 may also be practiced after the valve assembly has been placed into the top opening of the aerosol can. In this instance, the valve assembly would be opened by mechanical means and the pressure applied through the open valve.

The next step in the method of filling an aerosol can with a viscous product is to insert a valve assembly means 25 into the hole 15 in the top wall 14 of the can 10 such as illustrated in Fig. 6. The valve assembly means 25 rests on the edge member 16 surrounding hole 15. The step of inserting the valve assembly means in the hole 15 and the mechanical means for doing so are conventional and are not

illustrated.

The next step of the method of the present invention is illustrated in Fig. 7. Clamping head 50 includes clamping legs 51 for engaging top wall 14 of can 10. Clamping head 50 is connected to rod 52 which is connected to suitable means [not illustrated] for moving clamping head 50 up and down. Track members 60 [which will hereinafter be discussed in detail] are disposed within clamping head 50 and are spaced just slightly above lip 34 of valve assembly means 25. A nozzle 53 engages hole 13 in bottom wall 12 of can 10. The nozzle 53 is provided with a seal 54 for making a substantially fluid-tight engagement with the bottom 12 of can 10. Nozzle 53 is connected to a source of pressurized air [not illustrated] by conduit 55. Nozzle 53 is mounted on a rod 56 which is connected to suitable means for selectively moving nozzle 53 up and down, i.e., into and out of engagement with the bottom wall 12 of can 10 in alignment with hole 13.

Pressurized air from nozzle 53 will force slidable piston 21 upwardly in can 10 which in turn pushes viscous product 25 upwardly in the can until it substantially fills the air space 57 above the viscous product. That is, the enclosed volume of the can 10 above piston 21 has been substantially filled with the viscous product 25. As hereinbefore discussed, valve assembly means 25 has been placed but not fastened on edge member 16 surrounding hole 15 in the top wall 14 of can 10. As piston 21 moves upwardly in can 21, valve assembly 25 will be lifted off edge member 16 by the air being displaced from space 57 until the valve assembly contacts tracks 60. A path is thus provided for air to flow

out of hole 15 between edge member 16 and the lip 34 of valve assembly means 25. The tracks 60 only permit minimal upward movement of valve assembly means 25 so that valve assembly means 25 is substantially retained within hole 15 and enough space is not provided for the viscous product to leave the can. Tracks 60 may be said to be restraining valve assembly means 25. It will be appreciated that clamping member 25 is holding or restraining can 10 in place during this piston moving step.

The step illustrated in Fig. 7 may be referred to as a piston moving step or piston positioning step and may take place at what may be referred to as a piston moving station. The use of the track members 60, which will hereinafter be discussed, forms part of the present invention.

Instead of using tracks 60 of the present invention, the piston moving step may be performed using a conventional clamping head 65 such as illustrated in Fig. 8 and discussed in U.S. Patent No. 3,897,672. The clamping head 65 would be provided with a lower cylindrical portion for engaging the top wall 14 of the can 10. Openings would be provided in the clamping head 65 for the escape of air expelled from can 10 during the piston moving step. Clamp 65 would be provided with an internal shoulder 66 which, when the clamp engages can top wall 14, is spaced just slightly above lip 34 of valve means 25. The clamping head 65 would be connected, e.g., by a rod member 67 to suitable means, such as air cylinders, for moving clamping head 65 upwardly and downwardly.

Use of a conventional clamping head 65, such as illustrated in Fig. 8, would be satisfactory with slow moving

operations such as single station indexing machines. However, use of tracks 60, in accordance with the present invention, is particularly useful in high speed automated operation such as in-line, multiple index, multiple head machines as will be appreciated from the detailed discussion which will follow.

The piston moving step discussed in conjunction with Fig. 7 disclose the use of a pressurized fluid, typically a pressurized gas such as air, for moving piston 21 upwardly in can 10. It will be appreciated that one skilled in the art may use other means for moving piston 21. For example, piston 21 could be moved upwardly in can 10 by mechanical means by inserting a rod having appropriate control mechanisms through hole 13 and into contact with piston 21.

The viscous product dispensing step of the present invention, discussed in conjunction with Figs. 1 to 4, offers advantages over the prior art viscous product dispensing methods with respect to the piston moving step discussed in conjunction with Fig. 7.

When a can is filled with a viscous product by the hereinbefore described dispensing method of the present invention, a slight depression 68 is left in the center region of the viscous product as seen in Figs. 1 and 5.

In comparison, the prior art viscous product dispensing methods of moving a can downward as the can fills or withdrawing a tubular dispensing member from a can as the can fills with viscous product left a coning effect in the center region of the upper portion of the viscous product dispensed into the can. This coning effect may be observed

in Fig. 1 of U.S. Patent No. 3,897,672.

This coning effect has the following disadvantages with respect to the piston moving step discussed in conjunction with Fig. 7. When the piston 21 is moved upward in the can 10 during the piston moving step, air will become trapped between the viscous product and the top wall 14 especially in the regions toward the side wall 11. This trapped air will result in undesired sputtering and/or foaming of the viscous product when it is discharged from the can. It will be appreciated that the slight depression left in the center region of the viscous product by the filling method in accordance with the present invention will substantially eliminate trapped air between the viscous product and the can top wall 14 after the piston moving step and this will substantially eliminate such problems of sputtering and foaming of the viscous product which result from such trapped air.

The track members 60 of the present invention will now be discussed in conjunction with Figs. 7, 9, 10 and 11. After the piston 21 has been moved upwards in the can 10 to expel air in the space 57 above the viscous product, the can is next moved [as indicated by the arrow 69 of Fig. 9] to a crimping or fastening station [Fig. 11] where the valve assembly means 25 is crimped or fastened in a fluid tight manner to the can 10.

As illustrated in Fig. 7 and as hereinbefore discussed, parallel, spaced apart tracks 60 are positioned a slight distance above and in alignment with lip 34 of valve assembly means 25. Upward movement of piston 21 in the can 10 cause gas in space 57 to move the valve assembly means 25

a small distance upward into abutment with tracks 60. The upward movement of the valve assembly means 25 is thus limited by tracks 60 to retain the valve assembly means within the can top wall opening 15. There is sufficient upward movement of the valve assembly means 25 to provide a path to permit flow of gas out of can 10 via the top wall opening 15 between can edge member 16 and the lip 34 of the valve assembly means 25.

After the piston 21 has been moved upward in the can, the clamping head 50 is removed from the can, typically by upward movement of the clamping head 50. The parallel, spaced apart tracks are stationary and thus retain their position with respect to the valve assembly means 25. After removal of the clamping head 50, the can is transported to the crimping station 70 [Fig. 11] by conventional mechanical means [not illustrated].

As best illustrated Fig. 9, the stationary, parallel, spaced apart tracks 60 extend from the piston moving station toward the crimping station while retaining their relationship with valve assembly means 25 of being in alignment with and spaced a small distance above the lip 34 of the valve assembly means.

The reason the tracks 60 extend toward the crimping or fastening station is as follws. After the piston moving step has been completed and the clamping head 50 has been removed, residual pressure may remain and thus the escaping gas which results from the residual pressure [or the viscous product itself] could displace the valve assembly means 25 with respect to the can top wall opening 15 when the can is being transported to the crimping station. Misalignment of the

valve assembly could cause an unsatisfactory crimping of the valve assembly to the edge member 16 and thus result in the need to reject the filled can. In addition, the misaligned valve assembly could result in a jam at the crimping station and necessitate stopping the production operation while the crimping station is unclogged.

Prior art clamping heads 65 such as illustrated in Fig. 8 and which did not have the tracks 60, in accordance with the present invention, resulted in these problems of misaligned valve assemblies which have been solved by the tracks 60 of the present invention. One skilled in the art will readily appreciate that the tracks 60 of the present invention would be especially useful when high speed automated operations are desired.

The tracks 60 of the present invention may extend all the way to being adjacent to the crimping or fastening station, if this is desired. The tracks 60 should at least extend a distance from the piston moving station toward the crimping or fastening station which is sufficient to permit venting of pressure from the enclosed volume of the can 10 above the piston during transporting of the can from the piston moving station to the crimping station in order to prevent misalignment of the valve assembly means.

Fig. 9 discloses the tracks 60 extending toward the valve assembly crimping or fastening station which is illustrated in Fig 11. End 61 of track 60 may be adjacent the fastening or crimping station. The can 10 is illustrated in Fig. 9 as being located in the piston moving station which is illustrated in detail in Fig. 7. The can 10 would be transported from the piston moving station to the crimping station

in the direction of the arrow 69. Means 62 are illustrated for mounting the tracks 60 in their desired stationary position. Means for mounting tracks 60 are not illustrated in detail because the could readily be provided for by one skilled in the art. It will be appreciated that mounting means 62 could be adjustable in order that tracks 60 can be located in selected stationary positions for cans of various sizes.

Fig. 10 is a schematic elevation view along line 10-10 of Fig. 9 illustrating parallel, spaced apart track members 60A and 60B of tracks 60 and their mounting means 62.

It will be appreciated by one skilled in the art that the track members 60, in accordance with the present invention, may be usefully employed with other methods for filling a piston type aerosol can with a viscous product such as the method as disclosed in U.S. Patent No. 3,897,672.

One skilled in the art could practice the viscous product dispensing step of the present invention and the top opening pressurization step of the present invention using dimple cup valves. Such valve types, which are mounted in what is the top wall of the aerosol can, are commonly used in the aerosol industry for charging or pressurizing cans using the under the cap (i.e. under the valve) method. The dimples prevent the valve from sealing on the lip during the charging. Although not preferred, such a valve type could be used with the viscous product filling method of the invention. The dimple cup valve would be snapped into position prior to the can being placed in the piston moving station. The dimple cup valve would eliminate the need for restraining the valve in position when the piston was moved

or positioned. However, the can itself would have to be held or restrained in position by a clamping head while the piston was being positioned.

After the piston has been moved upward in the can, the can is transported to a crimping or fastening station [Fig. 11] where the lip 34 of the valve assembly means 25 is crimped or fastened in a fluid tight manner to the edge member 16 of can 10. The crimping station may comprise a crimping mechanism 70 having expanding collets 71 for performing the crimping. The crimping station is not illustrated or discussed in detail because it is convention in the piston-type aerosol can art.

The aerosol can 10 is next transported by conventional means to a piston pressurization station illustrated in Fig. 12. A nozzle member 75 is provided to engage hole 13 in the bottom wall 12 of the can. The nozzle would be connected to a source of pressurized fluid, e.g., a pressurized gas such as pressurized air and would pressurize the region of the can below shell-like piston 21. The nozzle would then plug the hole with a precut grommet 76. A clamp member 77 would be provided to hold or restrain the can 10 in position when the can region below piston 21 is pressurized and the grommet 76 is inserted. Means [not illustrated] are provided for moving nozzle 75 and clamp 77 upwardly and downwardly with respect to the can 10. As illustrated in Fig. 12, grommet 76 has been inserted into hole 13 so the nozzle 75 is in a downward position out of engagement with the can bottom wall 12 and clamp 77 is in upward position out of engagement with the top wall 14 of can 10. If the can were being pressurized, the nozzle 75 would be in engagement

with can bottom wall 12 in alignment with hole 13 and the clamp 77 would be in engagement with the top of can 10 to restrain the can. The mechanisms of Fig. 12 have not been illustrated or described in detail because they are conventional and well known in the art.

EXAMPLES

In order to provide a more complete understanding of the present invention, the following examples, in accordance with the present invention, are set forth. It is understood that these examples are only illustrative and are not intended to limit the scope of the present invention which is defined in the claims.

Example I [overhead pressurization step not used]

A piston-type aerosol can having a nominal diameter of 2 2/16 inches and a nominal length of 5 9/16 inches was filled with a gel type of product. The filling operation took place at room temperature.

The diameter of the top wall opening of the can was about 1 inch. A gradually converging discharge nozzle was positioned as illustrated in Figs. 1 and 2, near the top wall opening of the can. The outside diameter of the nozzle at the discharge orifice was about 0.975 inches. The inside diameter of the discharge orifice was about 0.5 inches. About 150 grams of the gel viscous product were discharged into the can.

There were substantially no voids observed between the viscous product and the upper surface of the piston including the region between the skirt of the piston and the side wall of the can. The top wall opening pressurization step described in conjunction with Fig. 5 was not required.

The slight depression in the center region of the upper surface of the viscous product was observed. When the can was completely assembled and the region below the piston pressurized, operation of the valve to discharge the viscous product did not result in foaming or sputtering of the viscous product

Example II [overhead pressurization step used]

A piston-type aerosol can having a nominal diameter of 2 2/16 inches and a nominal length of 7 1/2 inches was filled with latex caulk which is a viscous product having a viscosity of about 220,000 centipose at 25°C. The filling operation tooke place at room temperature.

The diameter of the top wall opening of the can was about 1 inch. A gradually converging discharge nozzle was positioned as illustrated in Fig. 4 near the top wall opening of the can. The outside diameter of the nozzle at the discharge orifice was about 0.975 inches. The inside diameter of the discharge orifice was about 0.5 inch.

The viscous product was discharged into the can at a pressure of about 36 p.s.i.g. About 350 grams of the latex caulk were discharged into the can.

Some slight voids were observed between the viscous product and the upper surface of the piston especially in the region between the skirt of the piston and the wall of the can. The top wall opening pressurization step as described in conjunction with Fig. 5 was practiced. The viscous product was subjected to air pressure of about 17 p.s.i.g. through the top wall opening of the can for about 2.3 seconds. After this top wall opening pressurization step, there were substantially no voids observed between the viscous product

and the upper surface of the piston including the region between the skirt of the piston and the wall of the can.

The slight depression in the center region of the upper surface of the viscous product was observed. When the can was completely assembled and the region below the piston pressurized, operation of the valve to discharge the viscous product did not result in foaming or sputtering of the viscous product.

Depending on the viscosity of the product, one skilled in the art may vary the pressure at which the product is discharged into the can and vary the area or diameter of the discharge or exit orifice of the dispensing nozzle to obtain optimal results for a given product. Variation of these parameters will directly effect the velocity at which the viscous product is discharged into the can. In general, the pressurization step of the present invention, described in conjunction with Fig. 5, may be found most useful when filling the aerosol can with a very viscous product.

Whereas the gradually converging nozzle [sometimes referred to in fluid mechanics as a fire hose type nozzle] discussed in conjunction with Figs. 2 and 3 is preferred in the practice of the present invention, other nozzle types which will discharge the viscous product at high pressure and which will not cause the discharged high velocity jet of viscous product to substantially expand upon exiting the nozzle discharge orifice may prove satisfactory. The discharge of a high velocity jet of viscous product is most important and in some instances an abruptly converging nozzle may be satisfactory provided spreading of the viscous product occurs upon commencement of the filling of a can.

Although preferred embodiments of the present invention have been described in detail, it is contemplated that modifications may be made by one skilled in the art within the spirit and scope of the present invention.

WHAT IS CLAIMED IS:

1. A method of filling and pressurizing a can having a top end with an opening, a side wall, a bottom wall formed with a hole, wherein said side wall and said bottom wall provide an enclosed volume, and a piston positioned within said can enclosed volume, said piston having a periphery closely adjacent said side wall, with said piston being slidable along the axis of the can, said method comprising the steps of:

(a) positioning a nozzle having a discharge end with a discharge orifice so that said discharge orifice is located near said top opening of said can;

(b) dispensing a viscous product flowing under pressure in said nozzle into said can enclosed volume through said nozzle with a pressure sufficient for causing said viscous material impinging on said piston to spread toward the periphery of said piston and said side wall;

(c) continuing dispensing said viscous product into said can enclosed volume through said nozzle into order to fill said can with a selected amount of said viscous product;

(d) maintaining the position of said nozzle near said top opening of said can throughout said dispensing steps (b) and (c);

(e) maintaining said can stationary with respect to motion parallel to said can axis throughout said dispensing steps (b) and (c);

(f) placing valve assembly means into the top opening of said can after said dispensing steps (b) and (c);

(g) moving said piston upwardly in said can so that said viscous product substantially fills the enclosed volume of said can above said piston while permitting gas to flow out of the top opening of said can during said upward movement of said piston;

(h) applying fluid pressure to the hole at the bottom of said can thereby providing a pressure beneath said piston;

(i) plugging said hole in the bottom of said can;

(j) restraining said valve assembly means in the top opening of said can and restraining said can during said piston moving step (g) said fluid pressure applying step (h) and said plugging step (i); and

(k) maintaining a pressure within said can below said piston at the exterior ambient pressure or greater throughout said steps (a) through (j).

2. A method as recited in claim 1 wherein said nozzle discharge orifice located near said top opening of said can is disposed within said can and wherein the cross-sectional area of said nozzle adjacent said top opening of said can is less than but substantially equal to said cross-sectional area of said top opening whereby fluid communication between said can enclosed volume and the exterior is restricted thereby providing a positive pressure within said can enclosed volume during said dispensing steps (b) and (c) for filling any voids between said viscous product and said piston.

3. A method as recited in claim 1 wherein the discharge end of said nozzle contacts said top end of said can with said discharge orifice aligned with said top opening whereby fluid communication between said can enclosed volume and the exterior is restricted thereby providing a positive pressure within said can enclosed volume during said dispensing steps (b) and (c) for filling any voids between said viscous product and said piston.

4. A method as recited in claim 1 wherein the nozzle discharge orifice located near said top opening of said can is positioned external to said can enclosed volume with said discharge orifice aligned with said top opening and wherein the cross-sectional area of said nozzle discharge orifice is substantially less than the cross-sectional area of said top opening of said can.

5. A method as recited in claim 4 wherein the diameter of said nozzle discharge orifice is about 1/2 the diameter of said top opening.

6. A method as recited in any of claims 1 to 3, which further includes the step of:

(l) applying fluid pressure to said top opening after said viscous product dispensing step (c) thereby substantially filling any remaining voids between said viscous product and said piston.

7. A method as recited in claim 4 or claim 5 which further includes the step of:

(l) applying fluid pressure to said top opening after said viscous product filling step (c) to substantially fill any remaining voids between said viscous product and said piston.

8. A method as recited in claim 6 or 7 wherein said applying fluid pressure step (l) is carried out prior to said valve assembly placing step (f).

9. A method as recited in claim 6 or 7 wherein said applying fluid pressure step (l) is carried out after said valve assembly placing step (f).

10. A method as recited in any of the preceding claims which further includes:

constricting said viscous product flowing under pressure in said nozzle as said flowing product approaches said discharge orifice of said nozzle thereby substantially preventing expansion of said pressurized viscous product as it exits said discharge orifice and substantially preventing expansion of a jet of viscous product discharged from said nozzled during said dispensing steps (b) and (c).

11. A method as recited in claim 10 wherein said viscous product is gradually constructed.

12. A method as recited in any of the preceding claim wherein:

said nozzle has a fluid conduit for transporting said viscous product flowing under pressure within said conduit terminating in said discharge orifice;

said conduit has a circular cross-sectional area A_1 at a location remote from said nozzle discharge end;

said discharge orifice has a circular cross-sectional area A_2 with A_2 being less than A_1.

13. A method as recited in claim 12 wherein the cross-sectional area of said conduit A_1 is gradually and smoothly contracted to said cross-sectional area A_2 near the discharge end of said nozzle;

whereby expansion of said pressurized viscous product as it exits said discharge orifice and expansion of a jet of viscous product discharged from said nozzle during said dispensing steps (b) and (c) is substantially prevented.

14. A method as recited in any of the preceding claims wherein said can has a top wall with an opening mounted on the top end of said can and further includes the steps of:

positioning said valve assemply means in said top wall opening;

performing said piston moving step (g) at a piston moving station;

fastening said valve assembly means to said top wall of said can in an airtight manner at a fastening station which is spaced from said piston moving station wherein said valve assembly means fastening step occurs prior to said fluid pressure applying step (h);

performing said valve assembly restraining step (j) during said piston moving step (g) by:

providing a pair of parallel, spaced apart tracks positioned above said piston moving station at a height and location such that said tracks are in alignment with and displaced a small distance above said valve assembly means when said can is in said piston moving station; whereby

said moving said piston upward causes gas within said can to move said valve assembly means upward into abutment with said tracks with said upward movement of said valve assembly being limited by said tracks to retain said valve assembly means within said top wall opening of said can but permitting valve assembly means upward movement sufficient to permit said flow of gas out of said top wall opening; and

transporting said can to said fastening station after completion of said piston moving step wherein said parallel, spaced apart tracks extend a distance from said piston moving station toward said fastening station sufficient to permit venting of pressure from the enclosed volume of said can above said piston during said transporting.

15. A method as recited in any of the preceding claims wherein said piston is moved upwardly in said can in step (g) by applying a pressure through the hole at the bottom of said can.

16. A method as recited in any of the preceding claims wherein said restraining of said valve assembly means step (j) occuring during said piston moving step (g) permits limited upward movement of said valve assembly to permit said gas to flow out of the top wall opening of said can.

17. A method as recited in claim 16 wherein said can has a top wall with an opening mounted on the top end of said can; and,

said valve assembly means placing step (f) comprises seating said valve assembly means on an edge member surrounding said top wall opening but said valve assembly means is not fastened to said edge during said valve assembly means placing step (f) whereby said gas can flow out of the top wall opening of said can between said edge and said valve assembly means during said piston moving step (g); and including the step of,

crimping said valve assembly means to said edge member surrounding said top wall opening in an fluid tight manner following said piston moving step (g) and prior to said fluid pressure applying step (h).

18. A method of filling and pressurizing a can having a top wall with an opening, a side wall, a bottom wall formed with a hole, wherein said top wall, said side wall and said bottom wall provide an enclosed volume, and a piston positioned within said can enclosed volume, said piston having a periphery closely adjacent said side wall with said piston being slidable along the axis of said can, said method comprising the steps of:

(a) dispensing a viscous product into said can enclosed volume in order to fill said can with a selected amount of said viscous product;

(b) placing a valve assembly into the top wall opening of said can after said dispensing step (a) by seating but not fastening said valve assembly on an edge member surrounding said top wall opening;

(c) moving said piston upwardly in said can at a piston moving station so that said viscous product substantially fills the enclosed volume of said can above said piston while gas flows out of the top wall opening of said can between said edge member and said valve assembly during said upward movement of said piston;

(d) transporting said can to a valve assembly fastening station which is spaced from said piston moving station;

(e) providing a pair of parallel, spaced apart tracks positioned above said piston moving station at a height and location such that said tracks are in alignment with and displaced a small distance above said valve assembly when said can is in said piston moving station; whereby,

(1) said moving said piston upward causes gas within said can to move said valve assembly upward into abutment with said tracks with said upward movement of said valve assembly being limited by said tracks to retain said valve assembly within said top wall opening of said can but permitting valve assembly upward movement sufficient to permit said flow of gas between said edge member and said valve assembly; and wherein

(2) said parallel, spaced apart tracks extend a distance from said piston moving station toward said fastening station sufficient to permit venting of pressure from the enclosed volume of said can above said piston during said transporting step (d);

(f) fastening said valve assembly to said edge member in an fluid tight manner at said fastening station;

(g) applying fluid pressure to the hole at the bottom of said can thereby providing a pressure beneath said piston; and

(h) plugging said hole at the bottom of said can.

19. A method as recited in claim 18 which further includes the steps of:

(i) applying fluid pressure to said top wall opening after said viscous product dispensing step (a) thereby substantially filling any voids between said viscous product and said piston; and

(j) maintaining a pressure within said can below said piston at the exterior ambient pressure or greater throughout said steps (a) through (i).

20. A method of filling and pressurizing a can having a top end with an opening, a side wall, a bottom wall formed with a hole, wherein said top wall, said side wall and said bottom wall provide an enclosed volume, and a piston positioned within said can enclosed volume, said piston having

a periphery closely adjacent said side wall with said piston being slidable along the axis of said can, said method comprising:

(a) dispensing a viscous product into said can enclosed volume in order to fill said can with a selected amount of said viscous product;

(b) applying a fluid pressure to said top end opening after said viscous product dispensing step (a) thereby substantially filling any void between said viscous product and said piston;

(c) placing valve assembly means into the top end opening of said can;

(d) moving said piston upwardly in said can so that said viscous product substantially fills the enclosed volume of said can above said piston while permitting gas to flow out of the top end opening of said can during the upward movement of said piston;

(e) applying fluid pressure to the hole at the bottom of said can thereby providing a pressure beneath said piston;

(f) plugging said hole in the bottom of said can; and,

(g) restraining said valve assembly in the top opening of said can and restraining said can during said piston moving step (d), said fluid pressure applying step (e) and said plugging step (f).

21. A method as recited in claim 20 wherein said fuid pressure applying step (b) occurs prior to said valve assembly means placing step (c).

22. A method as recited in claim 20 wherein said fluid pressure applying step (b) occurs after said valve assembly means placing step (c).

23. A method as recited in claim 19 wherein said fluid pressure applying step (1) occurs prior to said valve assembly means placing step (f).

24. A method as recited in claim 19 wherein said fluid pressure applying step (1) occurs after said valve assembly means placing step (f).

25. A pressurized filled can manufactured by the method of any of the preceding claims

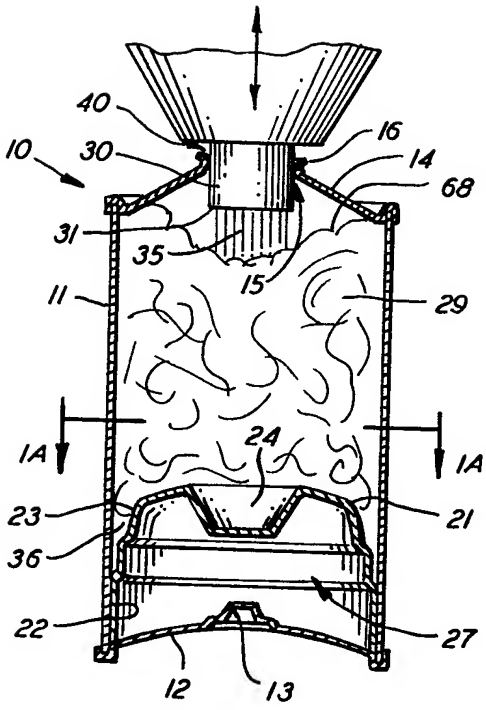

FIG. 1

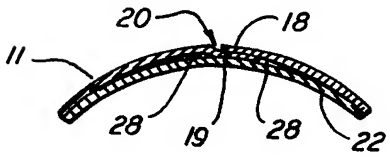

FIG. 1A

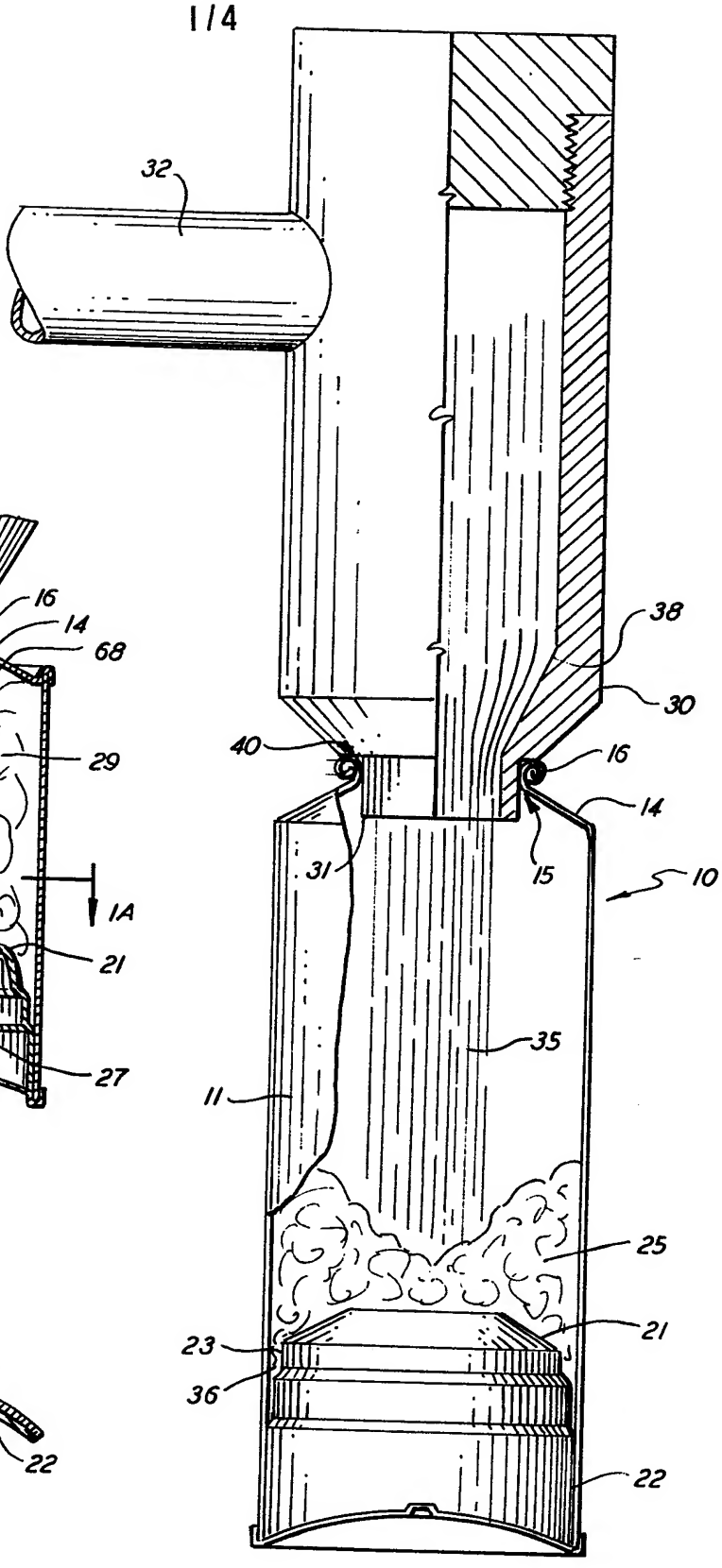

FIG. 2

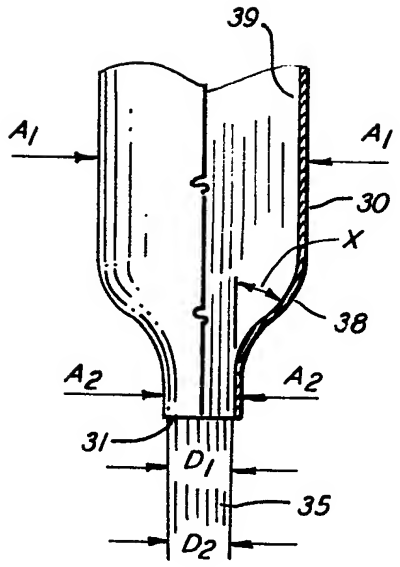

FIG. 3

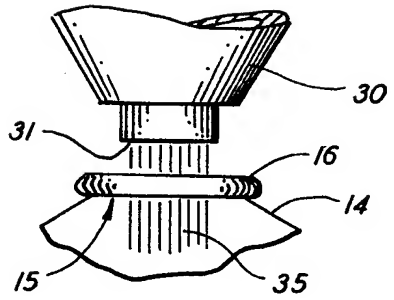

FIG. 4

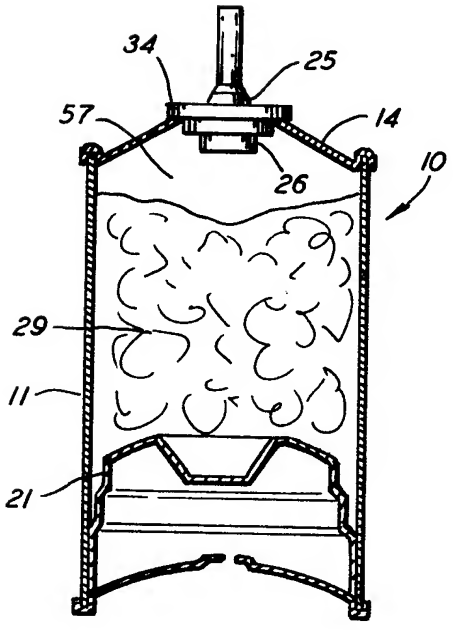

FIG. 6

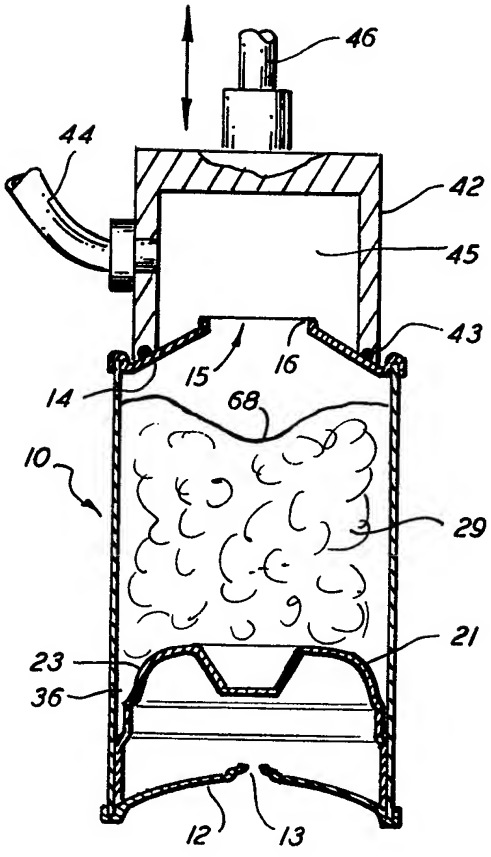

FIG. 5

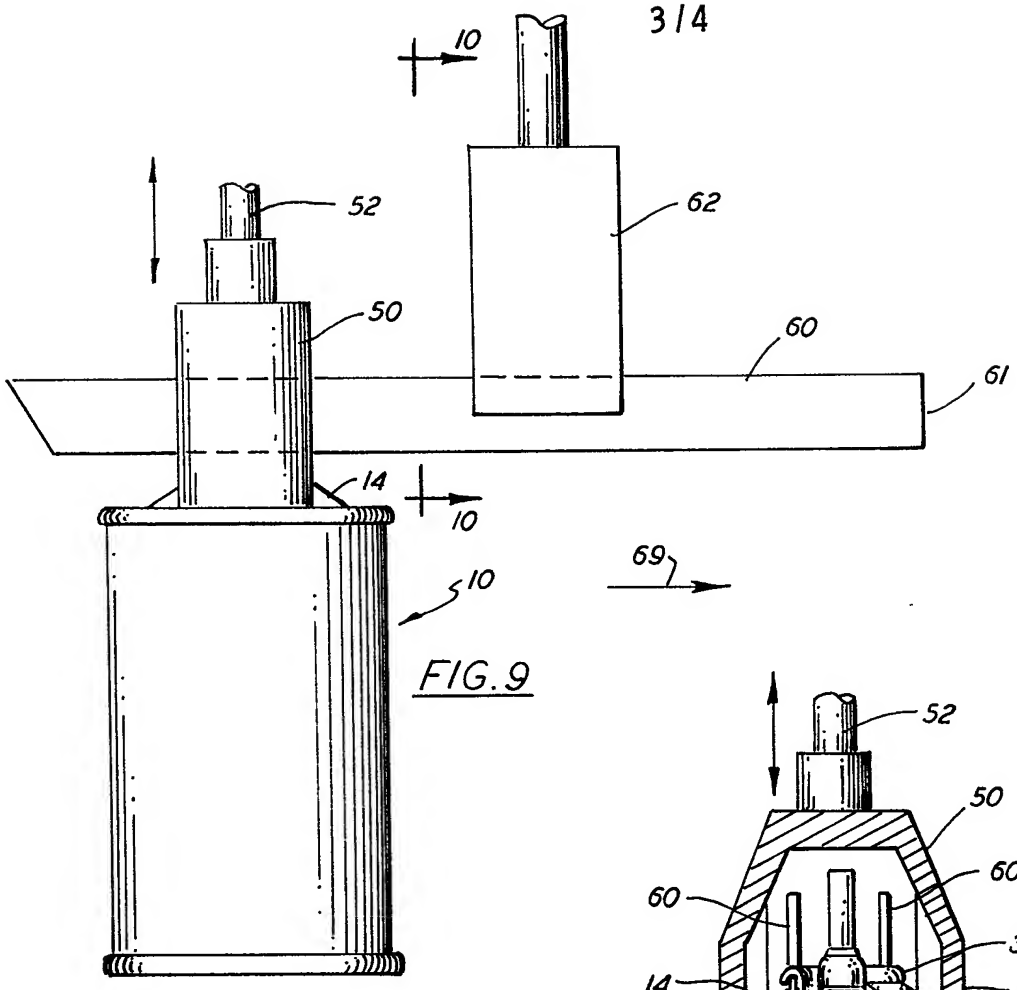

FIG. 9

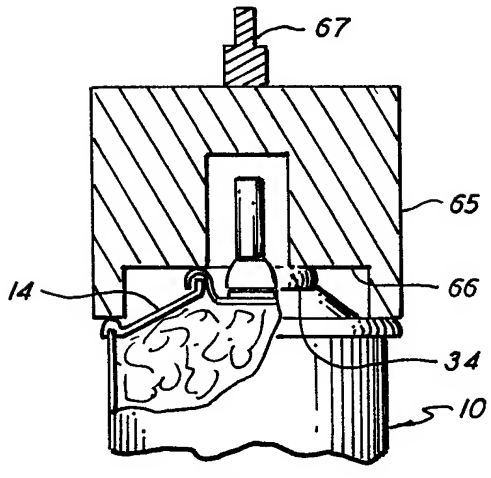

FIG. 8
Prior Art

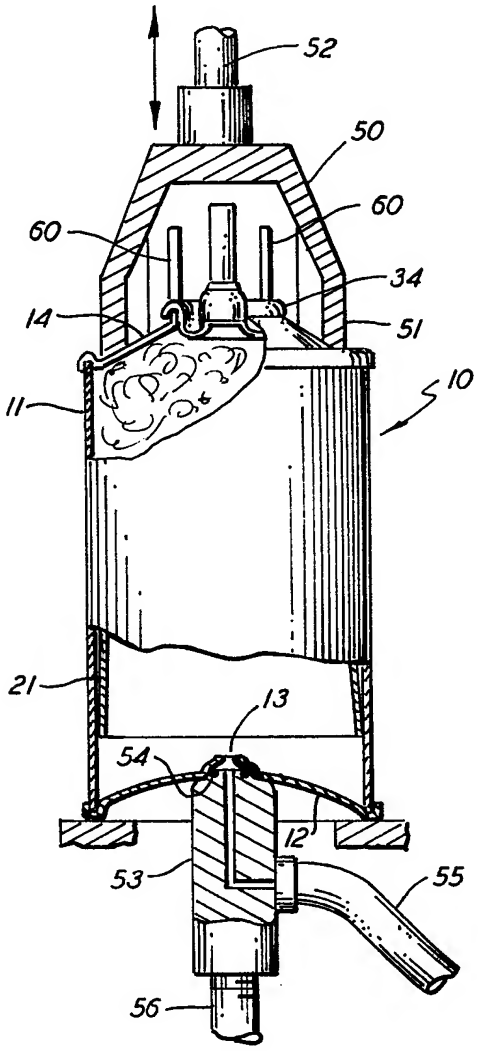

FIG. 7

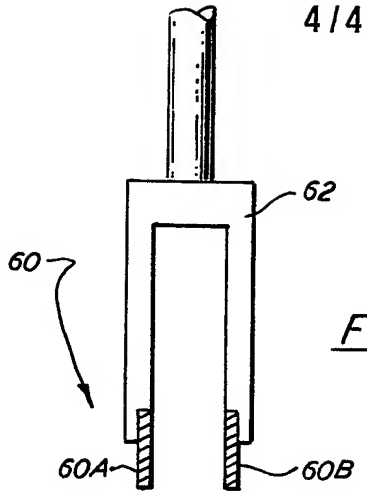

FIG. 10

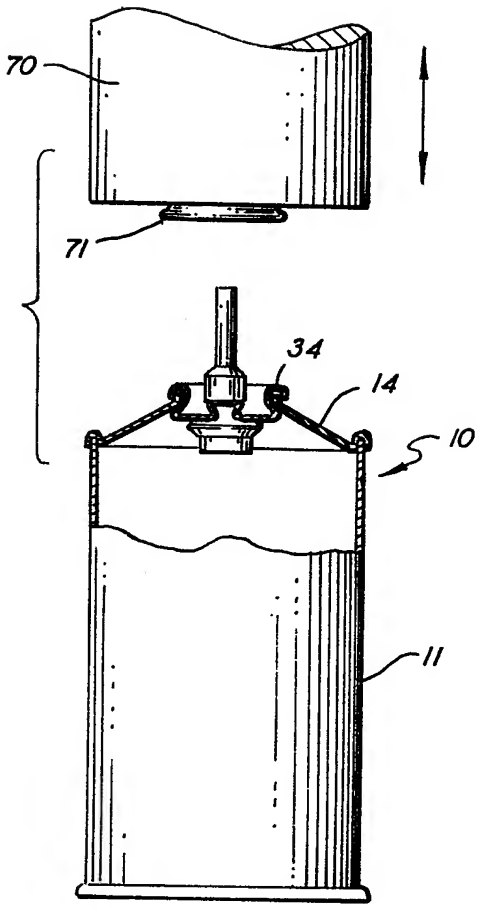

FIG. 11

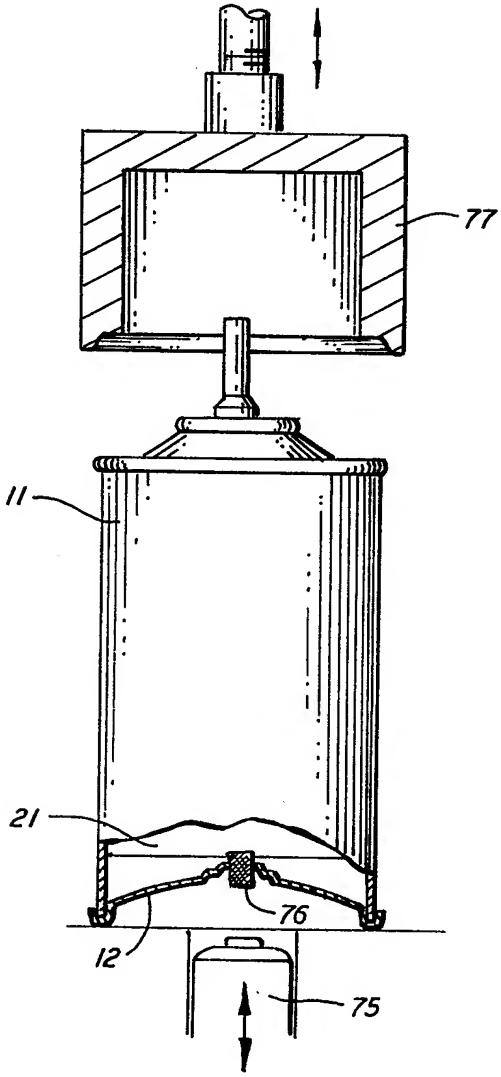

FIG. 12

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DOCUMENT-IDENTIFIER: EP 136104 A2

TITLE: Method for filling an aerosol can with a viscous product.

PUBN-DATE: April 3, 1985

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APPL-NO: EP84305912

APPL-DATE: August 29, 1984

PRIORITY-DATA: US52775383A (August 30, 1983)

INT-CL (IPC): B65B031/00 , B65B003/04

EUR-CL (EPC): B65B003/04 , B65B031/00

US-CL-CURRENT: 141/94

ABSTRACT:

A piston type aerosol can (10) is filled with

a viscous product by a nozzle (30) positioned near the top wall (14) opening of the can during the entire step of discharging the viscous product into the can. The nozzle preferably prevents substantial expansion of the jet of viscous product that exits the nozzle. When the jet of viscous product strikes the piston (21) in the lower portion of the can, a slight cavitation results and the viscous product spreads towards the side wall (23) of the can and fills the region (36) between the skirt of the piston and the side walls of the can. After the can has been filled with the viscous product, a gaseous pressure may be introduced at the top wall opening of the can to force the viscous product into contact with the top surface of the piston and completely into the region between the skirt of the piston and the side walls of the can. A track assembly (60) may be provided at a piston moving or positioning station with the track assembly extending toward a valve assembly crimping station wherein the track assembly maintains a valve assembly means (25) in position within the top wall opening (15) of the aerosol can during a piston raising step while permitting slight upward movement of the valve assembly to allow gas to escape from the can. Extending the track assembly (60) in the direction of the crimping station prevents the valve assembly from becoming misaligned due to residual pressure in the can as the can is transported from the piston raising station to a valve assembly/can top wall crimping station.